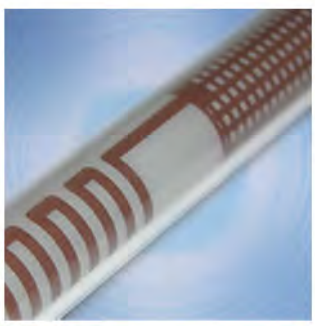
User's Manual

PA516 Series

AM RF Power Amplifier

Base Line 1.70

Document Number: INS41834-2



Company Overview

RFI has been serving the needs of the wireless communications market for over 30 years. First founded as a manufacturer of antenna systems, RFI has grown to be a key player in the development, manufacturing and distribution of wireless technology and energy products. Through our extensive network of resellers, systems integrators and retail outlets, RFI is a key supplier to both industry and Government.

Our research and manufacturing facilities have talented people, sophisticated test equipment, state of the art software with class leading manufacturing systems and techniques. Additionally, we have in place a quality management program which is certified to ISO9001, environmental management system certification to ISO14001 and occupational health and safety standard AS4801 giving you complete confidence in everything we do.

RFI's products are truly innovative and as a result we are active around the globe taking our Australian designed and manufactured products to key markets in Asia Pacific, the Americas and EMEA regions via offices 'in-region' in addition to exporting directly to in excess of 50 countries.

One of RFI's key principals is to remain totally customer focused as we recognise our future depends on the success of our customers. We know that to be chosen as your supplier we must add value to your business and to achieve this we will work hard to deliver the best product when and where you need it and back this up with the very best technical support available.

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Disclaimer

Product part numbering in photographs and drawings is accurate at the time of printing. Part number labels on RFI products supersede part numbers given within this manual. Information is subject to change without notice.

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PA516 Series

AM RF Power Amplifier

Front View

Rear View

1. General Description

The PA516 Series are full-featured, high performance RF Power Amplifiers for the AM frequency band.

Two models are available. The PA516A covers operation across 531KHz-1250KHz, and the PA516B covers 531KHz-1750KHz. The PA516A may be used where IM products of lower frequencies in the range need to be suppressed above 1250KHz, or the PA516B may be used where such suppression is unnecessary, or where full band operation is required from a single unit.

These units offer high linearity amplifier performance that is suited for multi-carrier operation, and are packaged in a compact 19inch rack mount, 2RU enclosure.

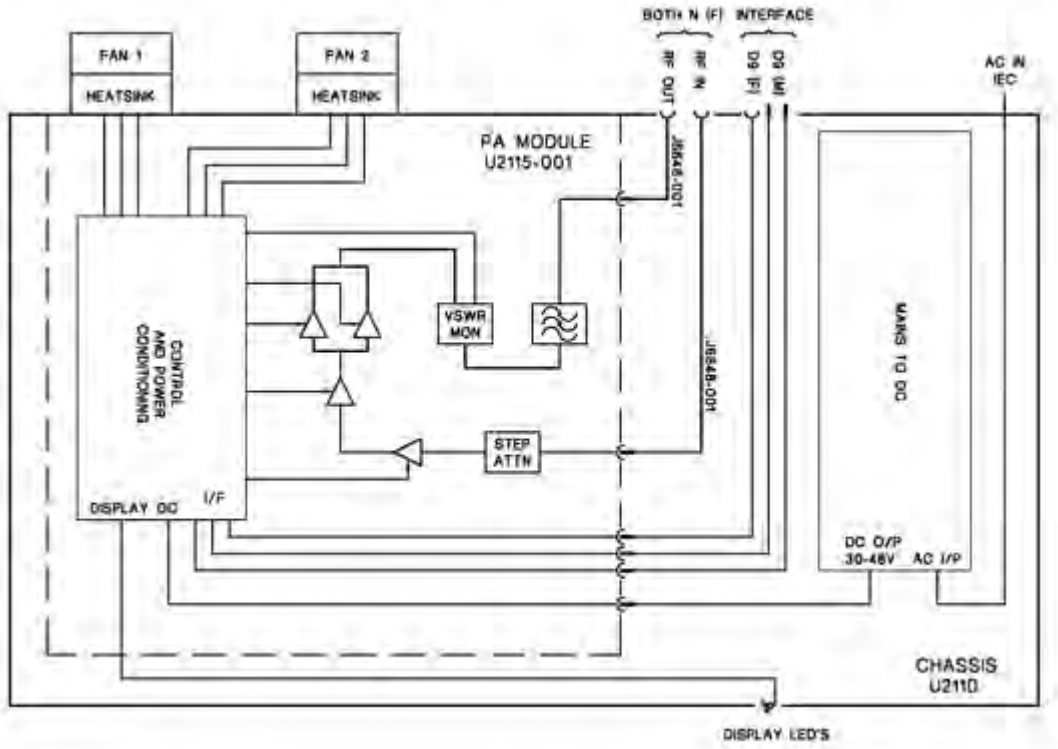

Figure 1 – PA516 Block Diagram

Various operating parameters are monitored and out-of-tolerance status alarm outputs are provided for use if desired. Alarm conditions provided include;

Minor Alarms:	Excessive VSWR. Cooling fan speed out of limits. Internal voltage rail out of limits.
Major Alarms:	Output power level more than 6 dB different from configured reference level. Internal temperature is above 85˚C. PA has been shut down due to excessive reverse power.

Front Panel LED indicators display the units' power, enabled state, VSWR and alarm status. These PA516 series units are available for operation from 240VAC +/-10% power systems.

Supporting documents including this User Manual, a Product Brief, an Application Note, and Service Bulletins are available from RFI.

2. Electrical and Mechanical Specifications

Model Number	PA516A / PA516B
Frequency Band	PA516A 531KHz – 1250KHz PA516B 531KHz – 1750KHz
Power Output	6 carriers at +30dBm per carrier (other carriers/powers combinations possible)
Gain	50-62dB in 1dB steps
Gain Flatness	+/-0.5dB over the prorated part of the AM frequency band
Intermodulation Distortion & Harmonics	< -35dBc (subject to carriers/powers combinations)
Output ALC Range	40dB minimum
RF Connector (Input)	N (F)
RF Connector (Output)	N (F)
RF Input Impedance	50 ohms
RF Output Impedance	50 ohms
Power Connector	Fused IEC Inlet (fused 5A)
Power Supply	240VAC +/-10% @ 800VA maximum
Alarm Functions	Minor: Excessive VSWR Cooling fan speed out of tolerance Internal voltage rail out of limits Major: RF Output level Internal Temperature PA Shut Down
Alarm Output Type	Dry Relay Contact (N.C. / N.O. / CMN) 60VDC 100mA
Alarm Connector	DB9 (Male)
Control Port Functions	Mute Interlock Control Mute Control Reverse Power Reset Control
Control Port Logic	Control Inputs source ~12VDC @ 1mA Active logic "low"
Control Port Connector	DB9 (Male)
Communications	RS232
Communications Connector	DB9 (Female)
Ambeint Temperature Range	0 deg C. to +50 deg C.
Cooling	Forced Air
Mounting	19in Rack Mount, 2 RU x 321mm deep
Case Size	443mm x 88mm x 321mm approx.
Finish	ROHS Compliant
Weight	~7.5kg (~16.5lbs)

Table 1

3. Ordering Information

Ordering Information	
RFI Part Number	**Description**
PA516A	AM RF Power Amplifier 531KHz – 1250KHz 240VAC 19in Rack Mount, 2RU
PA516B	AM RF Power Amplifier 531KHz – 1750KHz 240VAC 19in Rack Mount, 2RU

Table 2

4. Unpacking

The PA516 unit is packed in heavy-duty cardboard packaging.

Packed with the units will be the Factory Test Sheet (FTS). The User's Manual is available for download from the RFI website.

It is recommended to retain the Factory Test Sheet for future reference.

Although the packaging has been designed to provide suitable product protection during shipping, it is important to report any visible damage to the carrier immediately.

It is the customers' responsibility in the event of product damage, to lodge a damage claim with the carrier within a short period of time after receipt of the package. The time window for lodging the claim should be ascertained from the specific carrier as this may vary between carriers (typically 1 to 5 days).

Please dispose of all packaging material responsibly.

5. Firmware License Agreement

This statement must be read in its entirety prior to the loading or use of the Firmware provided by RFI.

Introduction.

By loading any product related Firmware you agree without reserve with all the conditions as detailed in this RFI Firmware License Agreement.

The term "Firmware" for the sake of this statement includes all software or firmware upgrades, either as a new installation, revision, patches or upgrades. Any reference to software, for the purposes of this license agreement, will therefore be included in the term Firmware.

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6. Installation

The PA516 is designed to be installed into standard 19inch rack mount frames or cabinet spaces and is intended for indoor use only.

Power connection to the unit must be made via the rear IEC connector with the required power capacity. The equipment must only be used with a properly earthed mains supply.

Cooling air for the unit is drawn in from the front of the unit and is expelled at the rear. Adequate provisions must be made to ensure that the air flow is not impeded at either the front or rear of the unit. Under no circumstances should the unit be allowed to become wet.

Ensure that the power source is disconnected before removal of any covers.

Installation Summary

Lightning protection, grounding, and the appropriate torqueing of connectors and the sealing of terminations are all important facets of any system installation. Careful attention should be given in these areas.

The type of coaxial feeder cables that may be used with the PA516 may vary, but generally their type will be determined by their length (and resulting insertion loss) and associated jumper/tail requirements.

Always follow engineering best practices for equipment installation.

7. Setup and Operation

Terms and Conventions

Operator commands are displayed in upper case on the terminal screen, regardless of case setting on keyboard.

This manual uses the following notational conventions:

{ }	Text enclosed in curly brackets denotes variable operator input.
{A...F}	Means any one of A, B, C, D, E or F is required.
{high | low}	Means either "high" or "low" is required.
[ ]	Text enclosed in square brackets denotes the input is optional.
< >	Text enclosed in these symbols denotes a single command key.
_	Denotes a space.

Unless specified otherwise, all commands are executed by pressing the Enter key, <ENTER>.

Status LEDs

There are four LEDs on the Power Amplifier front panel which provide a summary of the system status as follows:

Power	Green - ON when the system is powered.
Active	Green - ON when the PA is enabled.
VSWR	Yellow - ON when a Reverse Power or VSWR fault is present.
Alarm	Red - ON when any alarm is active.

When the system firmware is being updated (refer to the DOWNLOAD command) the Power LED will be flashing. The alarm status will also be active during a firmware update.

Initial Setup

Connect a VT100 compatible terminal via a straight through 9 pin serial cable to the 9 pin female connector located in the rear of the unit.

Connect power to the unit.

Check that the power LED's on the front of the unit is illuminated green. Also note that the front and rear fans should be operating.

Confirm basic system functionality by issuing a **SHOW SYSTEM** command. Note that no channel module information will be display until they have been configured. At this stage it would be advisable to have the Software Interface Operating Instructions available for reference.

Set the module configuration for each of the 16 channel modules using the **SET CHANNEL x** command. Frequency, antenna selection, high or low band grouping, relative output level and muting on/off is to be set for each channel.

Following the setting of each channel the active system configuration can be observed using the **SHOW SYSTEM** command. In addition to the configured information additional information includes VCO status, RF level present at the antenna input, and RF output level for both tubes.

The unit should now be operational.

Terminal Commands

The following commands are available when a terminal is connected to the system serial port.

DEFAULT

Purpose: Returns all settings to factory defaults.

Syntax: default

Example: Type: `DEFAULT`

Response:
```
Are you sure? (YES/NO) >
```

Type: `YES` (must type "yes" in full)

Response:
```
All configuration data set to DEFAULTS

>
```

Comments: After this command, the settings will be as follows:

Gain = 50dB
Level Alarm Delay = 5 Sec
VSWR Alarm level = 1.50:1
Reference output power level = Not configured.

DOWNLOAD

Purpose: Initiates the download of updated firmware.

Syntax: download

Example: Type: `DOWNLOAD`

Response:
```
This will overwrite the current firmware!

Are you sure? (YES/NO) >
```

Type: `YES`

Response:
```
Ready to receive a new application.
- Activate the TRANSFER/SEND FILE (Binary) menu items,
- Select the relevant .BIN application file,
- If presented with the option, select XMODEM protocol,
- Press OK and/or SEND.
     To cancel a download:
- Send one or more CTRL-D characters, OR
- Hang up the modem, OR
- Unplug the local terminal.

If possible, the previous application will then be restarted.
```

At this point, activate your terminal software's File Transfer protocol. For example for Hyperterminal, invoke Transfer/Send File, then enter (or Browse) the filename (for example PA516A_V1_1.BIN), set the Protocol to Xmodem (NOT 1K Xmodem), then press the Send button.

When the transfer is complete, the new firmware will automatically start.

Comments: If the download of application code is interrupted or fails midway, the system will normally restart immediately with the previously active application. If it doesn't restart immediately, press CTRL-D one or more times, alternatively, wait for about 3 minutes, and the system will automatically abandon the download.

HELP

Purpose: Displays a brief summary of the available commands.

Syntax: help

The system responds by displaying help screens.

RESET REVPWR

Purpose: Resets the Reverse Power shutdown.

Syntax: reset revpwr

Example: Type: `RESET REVPWR`

Response: >

SET BAUD

Purpose: Sets the serial interface baud rate.

Syntax: set baud {1200 | 2400 | 4800 | 9600 | 19200}

Example: Type: `SET BAUD 19200`

Response:
```
The new serial baud rate will be activated now.

Press any key to continue
```

Comment: After a key is pressed, the new data rate will be active, so the terminal data rate should be changed either immediately prior to pressing the key, or immediately after.
The default data rate out of the factory is 9600 baud.

WARNING: If the baud rate is changed from the factory default, you may want to record this on the repeater enclosure for other maintenance staff.

SET GAIN

Purpose: Used to set the amplifier gain.

Syntax: set gain {50…62}

Example: Type: `SET GAIN 56`

Response: `> Gain = 56dB`

SET LEVEL

Purpose: Used to set the reference output power level.

Syntax: set level

Example: Type: `SET LEVEL`

Response:
```
Current output power = 41.3dBm.

This level will become the nominal level for alarm purposes.

Are you sure? (YES/NO) >
```

Type: `YES`

Comment: If the output power level deviates by more than +/-6dB from the level set with this command, a Major alarm condition will be activated.

If the reference output power level has not yet been configured, no output power level alarms will be generated.

SET LVLDELAY

Purpose: Sets the delay period before a level alarm is raised.

Syntax: set lvldelay {1..99}

Example: Type: `SET LVLDELAY 15`

Response:
```
Delay to Level Alarm = 15 Sec
```

Comment: The output power level needs to be more than 6dB above or below the Reference level for this period of time before an alarm is signalled.

SET NAME

Purpose: Used to designate the name of the site.

Syntax: set name {name}

Example: Type: `SET NAME SITE-1234A`

Response: >

Comment: The name can be up to 16 characters long. Any of the visible characters from a PC keyboard may be used, except for a space. When other commands such as SHOW ID and SHOW STATUS are used, they will include the site name.

SET SHUTDOWN RETRY

Purpose: Sets the delay before retrying the Reverse Power shutdown cycle.

Syntax: set shutdown retry <minutes>

Example: Type: `SET SHUTDOWN RETRY 10`

Response: `> Shutdown retry delay = 10 Min.`

Comment When an excessive Reverse Power level is detected (currently >35 dBm) the PA is shut down. The reverse power level is then re-checked 3 times at 10 Second intervals. If the fault condition persists this retry cycle is repeated once more after the delay specified with this command. If this fails to clear the fault condition the PA is permanently shut down until either the power is cycled, or an external Reverse Power Reset signal is applied.

The Minimum value is 0, which disables the feature, and the maximum value is 60 Min.

SET VSWR

Purpose: Sets the VSWR alarm level.

Syntax: set vswr <1.00...20.00>

Example: Type: `SET VSWR 2.5`

Response: `> VSWR alarm level = 2.50:1`

Comment When a VSWR level above this configured value is detected, the VSWR alarm is activated.

There is a hysteresis of 0.1 on this alarm. For example if the alarm activates on a VSWR of 1.90:1, it will remain active until the VSWR drops below 1.80:1.

SHOW ID

Purpose: Displays the Name, ID, Firmware Version and Serial number.

Syntax: show id

Example: Type: `SHOW ID`

Response:
```
SITE-1234A, PA516A, V1.6, Serial No.05080001
>
```

SHOW SHUTDOWN RETRY

Purpose: Displays the delay before retrying the reverse power (VSWR) shutdown cycle.

Syntax: show shutdown retry

Example: Type: `SHOW SHUTDOWN RETRY`

Response: `> Shutdown retry delay = 10 Min`

Comment See the command SHUTDOWN RETRY for more details.

SHOW SYSTEM

Purpose: Displays the system status.

Syntax: show system

Example: Type: SHOW SYSTEM

Response:

```
SITE-1234A, PA516A, V1.0,  Serial No.05080001

Gain  NomLvl  Level  Mute  PA   VSWR  Temp  Power  Minor-Alm  Major-Alm
56    41.3   40.5   NO    ON   OK    OK    OK       OK         OK

Level alarm delay = 15 Sec
VSWR alarm level  = 2.50:1
```

SHOW VERSION

Purpose: This command displays the firmware version.

Syntax: show version

Example: Type: SHOW_VERSION

Response:

```
Version  = 1.6

>
```

START

Purpose: Resets the screen to scrolling mode and re-displays the banner.

Syntax: start

Example: Type: START

Response:

```
(C) Copyright 2006-2012, RF Industries – PA516A, V1.6

>
```

8. Connectors and Connector Layout

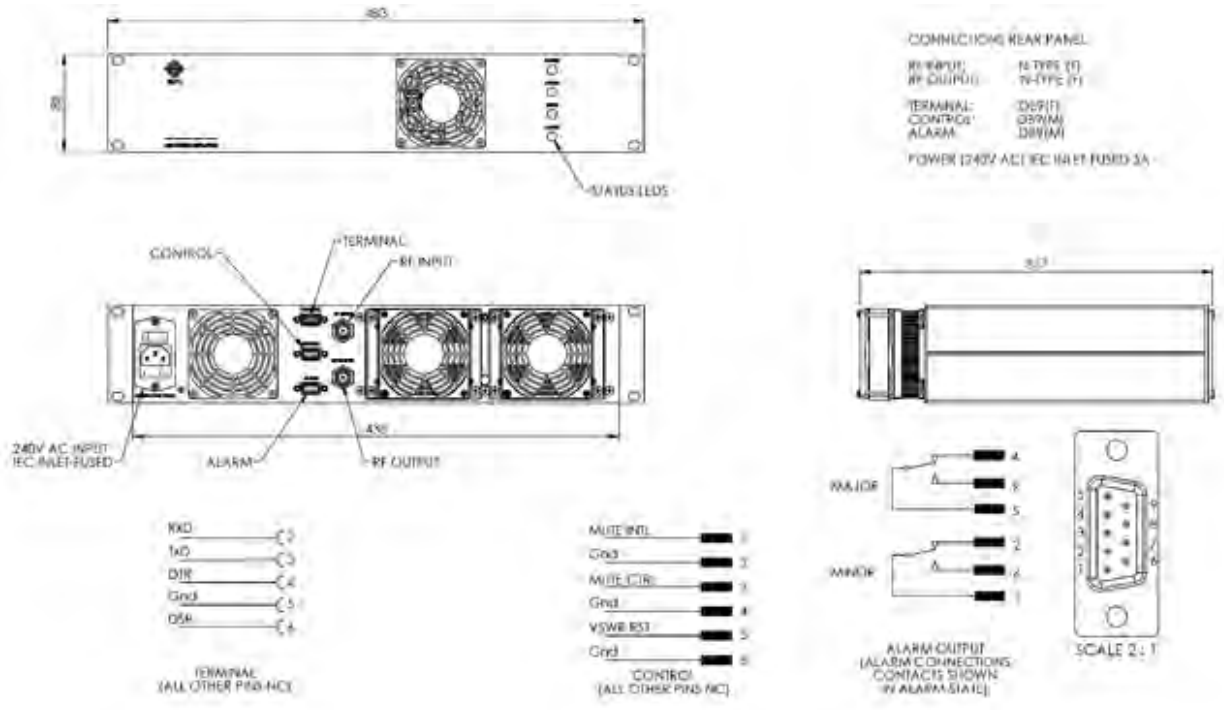

Figure 2 – PA516 Connectors

Serial Port

Purpose: The rear panel serial connector allows a local terminal to configure and report all aspects of the operation of the Power Amplifier.

Serial Format: The serial communications format is 8 data bits, no parity, 1 stop bit. Handshaking should be disabled. If the option is available, the terminal software should be configured to send a "Backspace, Space, Backspace" sequence when the Backspace key is pressed.

Data Rate: The data rate is preset in the factory to 9600 bits per second, it can be changed by software command to another rate (See the SET BAUD command)

Connections: The terminal connection is a DCE type via a female 9 pin 'D' screw-lock socket located on the rear panel of the Power Amplifier. A standard straight through serial cable can be used to connect the serial port to a PC serial port. The connections are:

Pin	Name	Function
1		Not Used
2	RxD	Serial data output from the Power Amplifier
3	TxD	Serial data input to the Power Amplifier
4	DTR	Input
5	Gnd	Ground
6	DSR	Output
7		Not Used
8		Not Used
9		Not Used

Alarm Connector

The Power Amplifier provides two changeover alarm contacts via a Male DB9 connector on the rear panel. Connections are as follows:

Pin	Name / Function
1	Minor alarm - Common.
2	Minor alarm – Closed on alarm.
3	Not used.
4	Major alarm – Closed on alarm.
5	Major alarm - Common.
6	Minor alarm – Open on alarm.
7	Not used.
8	Not used.
9	Major alarm – Open on alarm.

The alarm relay contacts are rated at 60VDC, 100mA.

Minor Alarms: Excessive VSWR.
Cooling fan speed out of limits.
Internal voltage rail out of limits.

Major Alarms: Output power level more than 6 dB different from configured reference level.
Internal temperature is above 85˚C.
PA has been shut down due to excessive reverse power.

Control Port

Purpose: The rear panel Control connector provides a local terminal to configure and report all aspects of the operation of the Power Amplifier.

The three external control signals are connected via a male DB9 connector on the rear panel.
When a control input is connected to the system ground, the respective signal is activated:

Pin	Name / Function
1	Mute Interlock control.
2	System ground.
3	Mute control.
4	System ground.
5	Reverse Power Reset control.
6	System ground.
7	Not used.
8	Not used.
9	Not used.

The control inputs source approximately 12VDC at about 1mA.

The three external control signals provide the following functionality;

Mute Interlock Control

- Not currently implemented. Available for future applications.

Mute Control

- Disables the PA516 RF Output for control and/or maintenance purposes.
  (Note: This also reduces PA516 power consumption to a nominal standby value)

Reverse Power Reset Control

- Facilitates external reset of a VSWR alarm state (i.e. VSWR Shutdown) if present.

9. Maintenance, Inspection and Repair Advice

No special maintenance program is required for the PA516.

It is recommended that the fans and fan filters be checked regularly and cleaned to ensure efficient and unobstructed air flow is achieved. Testing and inspection of the PA516 may be included in a Periodic Maintenance Inspection (PMI) program if desired.

Firmware upgrades may periodically be made available and may be uploaded for the PA516 via the Command Line Interface (CLI) if desired.

Checking that the RF connectors on all coaxial cables are correctly torqued (as per manufacturers' recommendations) is considered good practice.

All other connectors (power, alarm, control, etc) must be firmly located and pushed into their corresponding mating sockets, with fastening screws tightened securely.

The PA516 is not considered field repairable. Should it be considered that any unit may be faulty through diagnosis, they should be replaced - or returned to RFI for repair.

10. Background Material and other resources

For Product Briefs, User Manuals, Firmware Upgrade files or additional information on the RFI range of PA516 products please contact your nearest RFI Sales Office or visit: **http://www.rfiwireless.com.au**

11. User Notes:

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